



Points A and B are inside an electric field, as drawn to the left. An experiment reveals that it takes 100 joules of work to push a 2-coulomb charge along a straight line from point A to point B. But I don't know the distance from A to B, or the electric field strength.

- (a) Let's say the potential energy of the charge at point A was 0. What is its potential energy at point B?
- (b) If I repeated this experiment with a 4-coulomb charge, what would its potential energy be at point B?
- (c) What's the electrostatic potential, V , of point B?
- (d) To move a 2-coulomb charge from A to B along the dashed triangular path draw here, would it take more than 100 joules, less than 100 joules, or exactly 100 joules? Justify your answer.



$$\begin{aligned}
 \text{a) } \Delta U_{A \rightarrow B} &= \Delta W = 100 \text{ J} \\
 \Delta U &= U_B - U_A = 100 \text{ J} \\
 \Rightarrow U_B &= 100 \text{ J}
 \end{aligned}$$

$$\begin{aligned}
 \text{b) } \Delta W &= 2(100 \text{ J}) && \text{It's twice as hard to push} \\
 &&& \text{b.c. the force is twice as big} \\
 U_B &= 200 \text{ J}
 \end{aligned}$$

$$\text{c) } V = U/q \quad \text{Choose } V_A = 0$$

$$\begin{aligned}
 \text{First case: } V_B &= \frac{100 \text{ J}}{2 \text{ C}} = 50 \text{ J/C} \\
 \text{Second case: } V_B &= \frac{200 \text{ J}}{4 \text{ C}} = 50 \text{ J/C}
 \end{aligned}
 \left. \vphantom{\begin{aligned} \text{First case: } \\ \text{Second case: } \end{aligned}} \right\} \text{ same! (that's the idea)}$$

d)



Conservative force \Rightarrow

$$\Delta W = 100 \text{ J}$$

$\int_A^B \vec{F} \cdot d\vec{s}$ is same for any path

(like for gravity)